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New and interesting species of *Coprinus* (Coprinaceae, Agaricales) from Andalusia (Southern Spain)

by

A. Ortega[1] and F. Esteve-Raventos[2]

[1]Dpto. Biología Vegetal, Facultad de Ciencias, Universidad de Granada
E-18071 Granada, Spain. E-mail: aortegad@ugr.es
[2]Dpto. Biología Vegetal, Facultad de Biología, Universidad de Alcalá de Henares
E-28801 Alcalá de Henares, Spain. E-mail: fernando.esteve@uah.es

With 21 figures

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Abstract: A study of three species of *Coprinus* Pers. collected from Andalucía (Southern Spain) is made. *Coprinus alcobae* and *C. phaeopunctatus*, both belonging to subsection *Alachuani*, are described as new. Another rare species, *C. subimpatiens* M. Lange & A.H. Sm., belonging to subsection *Setulosi*, is recorded for the first time from the Iberian Peninsula. Line drawings and S.E.M. photographs of the spores of the three species are presented. A discussion with closely related taxa is made. The holotype of *C. maysoidisporus* Redhead & Traquair has been studied and compared with *C. phaeopunctatus*.

Resúmen: Se realiza un estudio de tres especies del género *Coprinus* Pers. recolectadas en Andalucía (España meridional). *C. alcobae* y *C. phaeopunctatus*, ambas pertenecientes a la subsección *Alachuani*, son descritas como nuevas. Otra rara especie, *C. subimpatiens* M. Lange & A.H. Sm., perteneciente a la subsección *Setulosi*, es registrada por vez primera en la Península Ibérica. Se presentan dibujos y fotografías de las esporas realizadas en el S.E.M. Se realiza una discusión taxonómica con los táxones más próximos. El holótipo de *C. maysoidisporus* Redhead & Traquair ha sido estudiado y comparado con *C. phaeopunctatus*.

Key words: Agaricales, *Coprinaceae*, *Coprinus*, Andalucía, Iberian Peninsula, Taxonomy, Chorology.

Introduction

Andalucía (Southern Spain) is one of the Spanish autonomous communities with a wider ecological diversity; the catalogue of plant communities includes a high and varied number of taxa, ranging from alpine areas (Sierra Nevada, Granada) to very arid and desertic sites (Tabernas region, Almeria). This is the probable reason why the fungal diversity is high, with a considerable high number of new species described

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recently, e.g. *Bolbitius elegans* (Horak et al., 2002), *Mycena dunicola* (Esteve-Raventós et al., 2001), *Sarcodon mediterraneus* (Ortega & Contú, 1990), etc.

In this work, we contribute three species of the genus *Coprinus* Pers. (*Coprinaceae* Roze), two of them new to science, collected in Granada, Málaga and Sevilla provinces.

Coprinus alcobae was gathered in the proximities of Aznalcázar (Sevilla), in typical mediterranean ecosystems (Esteve-Raventós et al., 2001; Migliozzi & Ortega, 2001) of continental dunes belonging to the *Oleo-Querceto suberis* communities, in rather poor soils and degraded vegetation, with an important reforestation including *Pinus pinea* L. or *Eucalyptus* spp.

Coprinus subimpatiens M. Lange & A.H. Sm. is a rare agaric, neither previously recorded from Sierra Nevada (Ortega & Buendía, 1986; Ortega et al., 1997) nor from the Iberian Peninsula; it was collected in the oromediterranean belt of Sierra Nevada in the *Genista versicoloris-Junipereto nanae* community, where some reforested *Pinus sylvestris* forests are located, and an important amount of *Pinus* debris causes the presence of a high number of saprotrophs.

In two recent contributions, Ortega et al. (1996, 2002), referred to the macrofungi flora of the distribution areas of the *Abies pinsapo* Boiss. forests in Cádiz and Málaga provinces (Andalucía); *C. phaeopunctatus* was there cited as *Coprinus* aff. *maysoidisporus* Redhead & Traquair from Yunquera (Málaga), growing on woody debris; an in-depth investigation has later allowed us to propose it here as a new species after a comparison with the holotype of *C. maysoidisporus*.

Material and methods

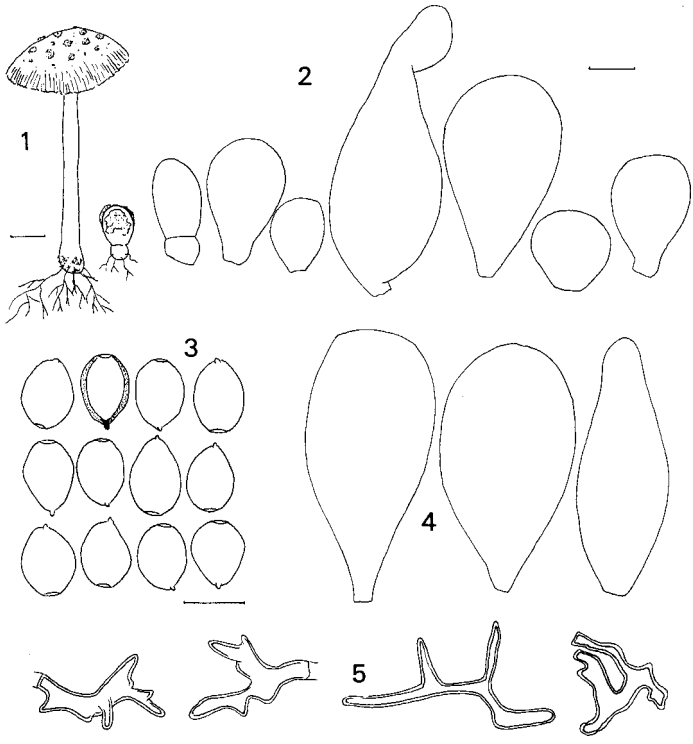
The material has been deposited in GDA (Herbarium of Granada University, Spain) and AH (Herbarium of Alcalá University, Spain). The holotype of *Coprinus maysoidisporus* was requested on loan from DAOM (Herbier National de Mycologie, Département d'Agriculture, Ottawa, Canada).

Spore measurements have followed the method proposed by Heinemann & Rammeloo (1985), where 30 measurements of each collection have been taken, which allows the calculation of maximum, medium and minimum values, as well as the length/width ratio (Q). Spores have been studied under the S.E.M., in a Zeiss DSM 950 microscope, following the methodology proposed by Moreno et al. (1995). Line drawings have been taken using a Nikon microscope and a camera lucida attachment. Chemical media used in the microscopical study have been 5% NH_4OH, Congo red in 3% ammoniacal solution, and concentrated sulfuric acid. Authors names abbreviations have followed Kirk & Ansell (1992).

Coprinus alcobae A. Ortega sp. nov. Figs 1-5, 16, 18, 19

Etymology: dedicated to my wife Lourdes Alcoba because of her interest and assistance in collecting samples throughout Andalucía over the last ten years.

Pileus primo 12-20 mm, subglobosus vel ovoideus, dein parabolicus vel convexus, 30-45 mm latus, ochraceo-brunneus vel griseus, totus flocculosus cum velo albo vel griseus. Lamellae liberae, ex albo nigricantes. Stipes 40-55 × 4-5.5 mm, cylindricus, versus basim incrassatus vel subbulbosus



Figs 1-5. *Coprinus alcobae* (Holotypus-GDA 45985). 1. Habit showing rhizomorphs and veil patches. 2. Cheilocystidia. 3. Spores. 4. Pleurocystidia. 5. Diverticulate elements of veil. Bars = 10 mm for fig 1, = 10 µm for other figs.

(-8.5 mm), albus, laevis vel minute fibrillosus. Sporae (9.5-)10-11.7 × 7-9 µm, obovoideae, saepe subangulatae, griseo-brunneae, poro germinativo centrico lato (1.5-2.5 µm) instructae. Basidia 18-33 × 8.5-10 µm, cylindrica, 4-sporigera. Pleurocystidia 35-110 × 25-35 µm, oblonga, subglobosa, ovoidea vel utriformia. Cheilocystidia similia. Velum e elementis diverticulatis × 4-8 µm, crassitunicatis (0.5-1 µm), griseo-flavidis, valde incrustatis constitutis. Pileipellis cutis hyphis cylindraceis, tenuitunicatis. Fibulae praesentes. Ad terram sabulosam in arenae continentalis.

Holotypus: Hispania: Sevilla, Aznalcázar, 26.10.2001, GDA 45985.

Material studied. - SPAIN: Sevilla: Aznalcázar, pinares de Aznalcázar, road Aznalcázar-Isla Menor, 26.10.2001, on sandy soils of continental dunes submitted to an important anthropomorphic action, in open and grassy areas under *Pinus pinea* L., *Pistacia lentiscus* L. and *Quercus ilex* subsp. *ballota* (Desf.) Samp., leg. L. Alcoba & A. Ortega, GDA 45985-holotypus.

Basidiomata (Figs 1, 16) gregarious to solitary. Pileus 12-20 mm diam. when still closed, 30-45 mm diam. when mature, at first ovoid to subglobose, then expanding to convex-paraboloid, completely covered with white veil when young, later splitting up in small, greyish felty patches, especially around centre, more fugacious towards

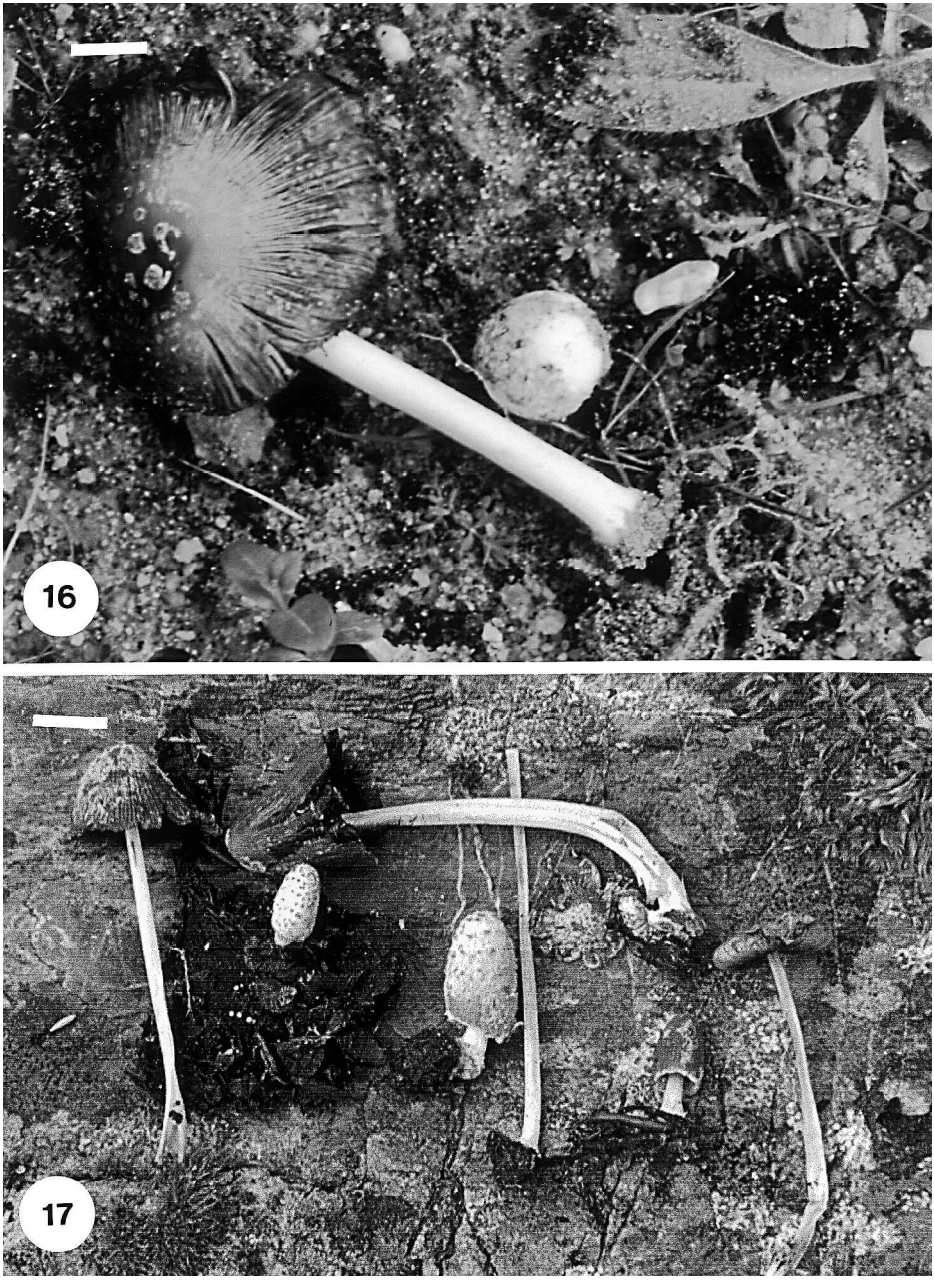


Fig 16-17. 16. *Coprinus alcobae* (Holotypus-GDA 45985). Basidiomata growing on sandy soil, showing well developed rhizomorphs. 17. *Coprinus phaeopunctatus* (Holotypus-AH 18881). Basidiomata in different developmental stages. Bars = 10 mm.

margin; pileus below veil honey-ochraceous, darker at centre, becoming dark greyish at maturity. Lamellae very crowded, free, at first white, then grey-brown and finally black. Stipe 40-55 × 4-5.5 mm, cylindrical, hollow, enlarged at base to subbulbous (-8.5 mm wide), whitish, surface smooth or somewhat fibrous with scattered velar remnants; stipe develops abundant cream-colour to ochraceous, branched rhizomorphs, often with adhering sand grains. Smell fungoid.

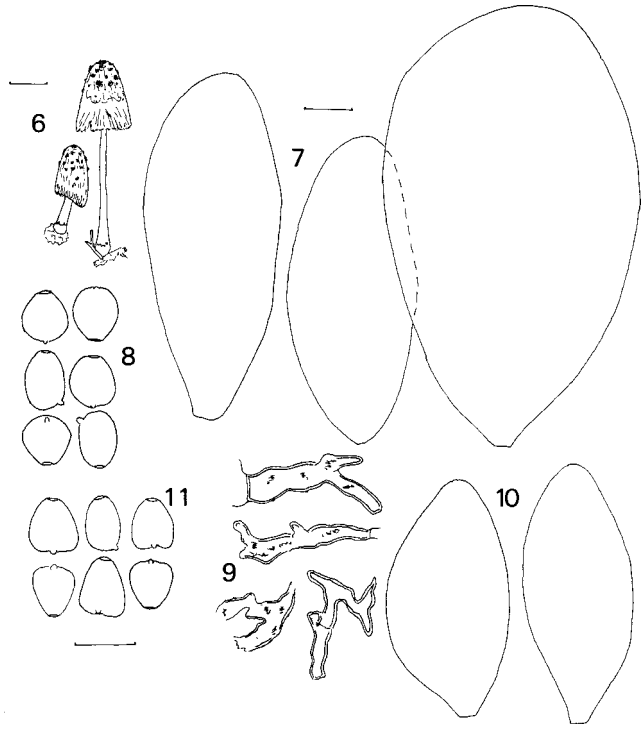
Spores (9.5-)10-10.9-11.7 × 7-8.2-9 µm, Q = 1.21-1.33-1.44 (n = 30), broadly obovoid, subangular at the proximal attenuated end, dark tobacco-brown, wall darker around the strongly projecting hilar appendix, with central, 1.5-2.5 µm wide germ pore (Figs 3, 18, 19). Basidia 18-33 × 8.5-10 µm, cylindrical, pedicellate, 4-spored, surrounded by 6-7 sterile cells ("pseudoparaphyses"). Pleurocystidia 35-110 × 25-35 µm, moderately numerous, subglobose, pyriform, oblong or utriform, thin-walled (Fig. 4). Lamellar edge sterile, formed by scattered cheilocystidia, similar to pleurocystidia, and abundant, shorter, subglobose to sphaeropedunculate cells, 17-35 × 13-20 µm (Fig. 2), arising from filamentous, frequently septate hyphae, 2.5-6 µm wide, forming subhymenial layer. Elements of veil thick-walled at places (0.5-1 µm), strongly to moderately diverticulate, 4-8 µm wide, brown-yellowish encrusted (Fig. 5). Clamp-connections present.

Observations. - *C. alcobae* fits within section *Coprinus* subsection *Alachuani* Singer by the presence of a veil composed of branched to diverticulate hyphae (Uljé & Noordeloos, 1997). It is probably a sabulicolous species, found in continental dunes with *Pinus*, mainly characterized by its stout habit, the rather developed rhizomorphs and, above all, the unique morphology of the large spores, which are obovoid with a subangular outline at the proximal half, and provided with a wide, central germ-pore. The white veil turns progressively ochraceous to greyish as the basidiomata mature, and is formed by coralloid, moderately thick-walled elements; this combination of characters is not shared by any species of this group. *Coprinus vermiculifer* Joss. ex Dennis shows a different velar composition, whereas *C. stanglianus* Enderle, Bender & Gröger, with similar size and habit to *C. alcobae*, shows thin-walled veil elements and spores with a different morphology (Bender & Enderle, 1988).

Coprinus phaeopunctatus Esteve-Rav. & A. Ortega sp. nov. Figs 6-11, 17, 20

Etymology: from latin "*phaeus*" = brown, fuscous, and "*punctatus*" = punctate, dotted, because of the brown dots or specks of veil on the pileus.

Basidiomata gregaria. Pileus primo 4-8 mm, conico-parabolicus vel campanulatus, dein convexus vel explanatus 15-20 mm latus, griseo-cinereus vel obscure griseus, totus flocculosus cum velo primo albo-cremeo, dein infuscato vel brunneo. Lamellae liberae, ex albo nigricantes. Stipes 20-40 × 2-3 mm, cylindricus, versus basim incrassatus vel subbulbosus (-5 mm), albus, laevis vel minute fibrillosus. Sporae 8-9.5 × 7-9 × 5.5-7 µm, lentiformes, rufo-brunneae, poro germinativo centrico lato (1.5-2.8 µm) instructae. Basidia 23-32 × 9-10(-12) µm, cylindrica vel clavata, 4-sporigera. Pleurocystidia 35-75(-100) × 25-50(-55) µm, ellipsoidea vel ovoidea. Cheilocystidia similia, sparsa. Velum e elementis diverticulatis x 4-6(-8) µm, leviter crassitunicatis (0.4-0.6 µm), interdum -1 µm valde incrustatis constitutis. Pileipellis cutis hyphis cylindraceis, tenuitunicatis. Fibulae praesentes. Ad ramulos et ligna putrescentia, in Sapinetum.



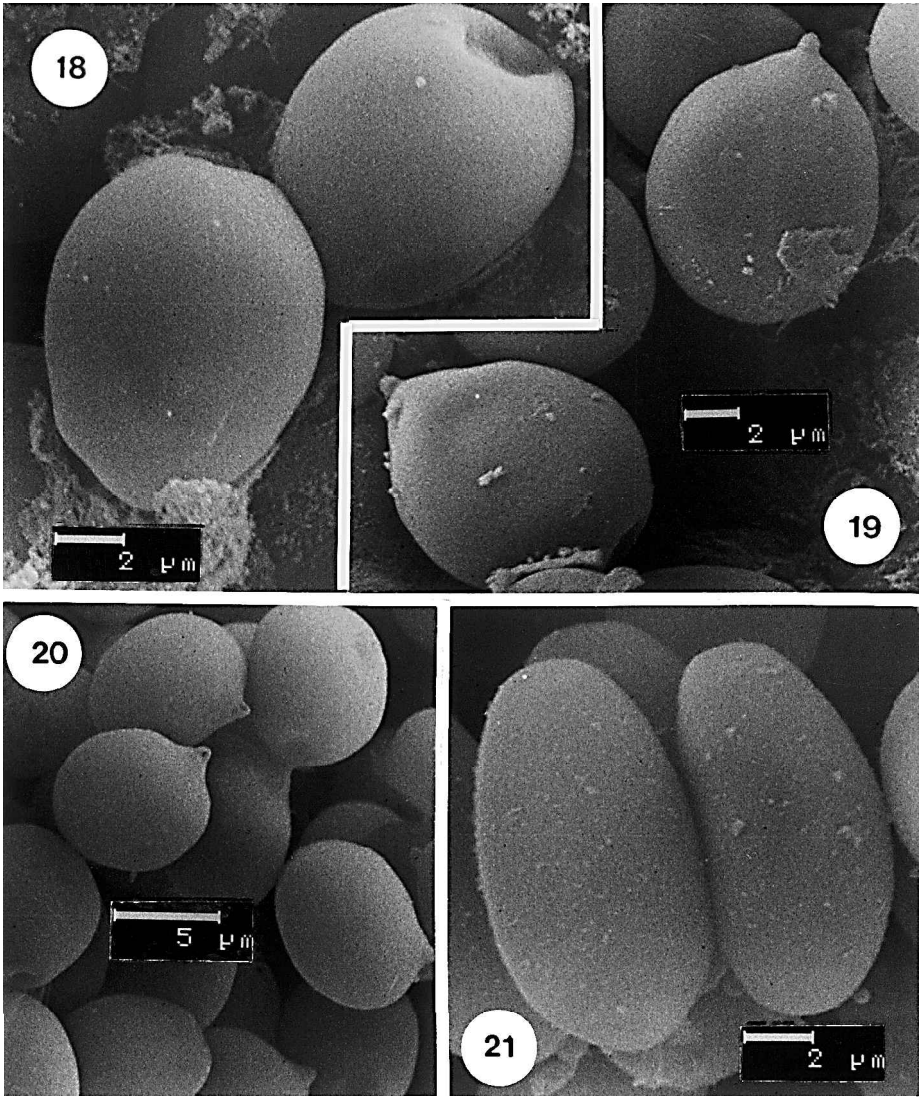
Figs 6-11. *Coprinus phaeopunctatus* (Holotypus-AH 18881). 6. Habit showing velar patches, brownish at the tips. 7. Pleurocystidia. 8. Spores. 9. Diverticulate elements of veil showing parietal and encrusting pigment. 10. Cheilocystidia. Fig 11. *Coprinus maysoidisporus* (Holotypus-DAOM 175231). Spores. Bars = 10 mm for fig 6, = 10 µm for other figs.

Holotypus: Hispania: Málaga, Yunquera, 01.11.1994, AH 18881.

Material studied. - SPAIN: Málaga: Yunquera, Tajo de La Caína, 01.11.1994, on rotten wood and debris of *Abies pinsapo* Boiss., *Ulex baeticus* Boiss. and *Cistus* sp., in *Abies pinsapo* forest, leg. L. Alcoba, F. Esteve-Raventós, E. Horak & A. Ortega, AH 18881-holotypus.

Comparative material examined. - *Coprinus maysoidisporus* Redhead & Traquair: CANADA: Alberta: Lethbridge, 11.04.1979, near *Medicago sativa* in greenhouse, leg. J. Traquair, DAOM 175231-holotypus.

Basidiomata (Figs 6, 17) gregarious. Pileus 4-8 mm diam. when still closed, 15-20 mm diam. when mature, at first conical-paraboloid, then expanding to campanulate or convex, with revolute deliquescent margin, at first completely covered with white to cream-coloured veil, later splitting up in small felty patches becoming brown at the tips, persisting around centre, more fugacious towards margin; pileus below veil greyish fuscous to grey-cinereous, becoming dark greyish to blackish at maturity



Figs. 18-21. Spores under the S.E.M. of 18. *Coprinus alcobae* (Holotypus). 19. *Coprinus alcobae* (Holotypus). 20. *Coprinus phaeopunctatus* (Holotypus). 21. *Coprinus subimpatiens* (GDA 45986).

upon deliquescence. Lamellae very crowded, free, at first white, then grey-brown and finally black. Stipe 20-40 × 2-3 mm, cylindrical, hollow, progressively enlarged towards base, subbulbous (-5 mm wide), whitish, surface smooth or somewhat fibrous with scattered velar remnants, sometimes forming a fibrillose pseudovolva around basal bulb; rhizomorphs absent. Smell fungoid.

Spores 8-8.8-9.5 × 7-8-9 × 5.5-6.2-7 µm, Q = 1-1.1-1.2 (n = 30), lentiform, often subtriangular at basal end with low roundish angles, flattened and ellipsoid in profile, with markedly eccentric apicula in lateral view, dark red-brown in ammoniacal solution, blackish-brown in water, quickly losing their color in concentrated sulfuric acid, with central, 1.5-2.8 µm wide germ-pore (Figs 8, 20). Basidia 23-32 × 9-10 (-12) µm, cylindrical to clavate, strongly pedicellate, 4-spored. Pleurocystidia 35-75(-100) × 25-50(-55) µm, moderately numerous, broadly ellipsoid to ovoid, thin-walled (Fig. 7). Cheilocystidia similar in shape to pleurocystidia, somewhat narrower (18-30 µm wide), scattered along the edge (Fig. 10). Elements of veil very compact, moderately thick-walled (0.4-0.6 µm), to thick walled at places (-1 µm), with scattered diverticulae, 4-6(-8) µm wide, yellowish-brown, with both intraparietal and encrusting pigment (Fig. 9); young veil whitish, thin-walled. Clamp-connections present.

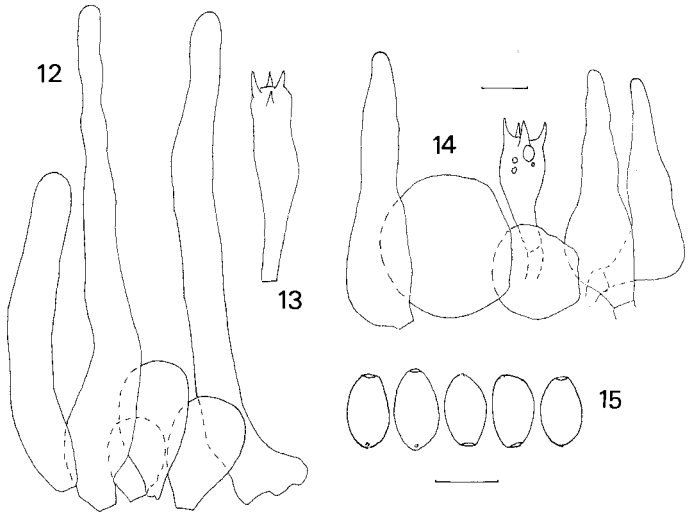
Observations. - This new species fits within subsection *Alachuani* Singer, and its combination of lentiform spores, large cystidia, moderately thick-walled brown veil, and habitat on rotten debris are diagnostic. The *Coprinus* species with diverticulate veil have been the object of more or less recent studies or revisions (Pilát & Svrcek, 1967; Orton & Watling, 1979; Redhead & Traquair, 1981; Citerin, 1992, 1994; Uljé & Noordeloos, 1996, 1997), where the importance of spore morphology, veil appearance, basidiomata size and habitat is emphasized in this group, sometimes named section *Herbicolae* Pilát & Svrcek or subsection *Alachuani* Singer. Redhead & Traquair (1981) consider the loss of color of the spores in sulfuric acid of taxonomic signifiance, a chemical test hardly used in the methodology of this group.

C. phaeopunctatus shows lentiform spores similar to those of the carbonicolous *C. gonophyllus* Quél. and the North American herbicolous *C. maysoidisporus* Redhead & Traquair. Apart from habitat, *C. gonophyllus* shows a thin-walled, white veil which does not become brownish at maturity, and the spores have a roundish base; morphologically, the typical "kernel"-like spores of *C. maysoidisporus* (Fig. 11) apparently remind those of *C. phaeopunctatus*, but the base of the spores is typically triangular to subcordiform in this species; all other characters, except habitat, are similar in both, including the rapid spore decoloration in sulfuric acid.

Among the European species of subsection *Alachuani* Singer, recently revised by Uljé & Noordeloos (1997), *C. phaeosporus* P. Karst. (= *C. saichiae* Reid) shows similar veil elements, but the spores are smaller (5.5-8 × 4.7-7 × 4.4-6.1 µm) than in our new species and provided with an eccentric to subeccentric, and smaller germ pore. *C. pseudofriesii* Pilát & Svrcek, which may grow on wood, shows more ellipsoid, not distinctly lentiform spores and subcylindrical to narrowly utriform cystidia. Finally, *C. xantholepis* P.D. Orton shows smaller spores (5-7.2 × 4.5-6.2 µm), very large pleurocystidia [80-180 × 25-40(-60)] and is herbicolous.

Coprinus subimpatiens M. Lange & A.H. Sm., Mycologia 45: 772. 1953
Figs 12-15, 21

Material studied. - SPAIN: Granada: Parque Nacional de Sierra Nevada, Las Sabinas, road from Pradollano to Veleta, 2300 m, 30.10.1999, on soil in *Pinus sylvestris* L. forest, leg. L. Alcoba & A. Ortega, GDA 45986.



Figs 12-15. *Coprinus subimpatiens* (GDA 45986). 12. Pileocystidia projecting over hymenoderm. 13. Basidium. 14. Globose elements and cheilocystidia at lamellar edge. 15. Spores. Bars = 10 µm.

Basidiomata gregarious. Pileus 15-20 × 12-17 mm diam., at first paraboloid, then expanding to campanulate or convex, with deeply sulcate margin, smooth, dark reddish brown to yellow-brown, paler towards the margin upon drying. Lamellae very crowded, free, white becoming blackish. Stipe 50-85 × 1.5-3 mm, cylindrical, white, pubescent. Veil absent. Smell fungoid.

Spores 10.5-11.9-13 × 6.5-7.3-8 µm, Q = 1.5-1.63-1.8(-1.85), ellipsoid, with subeccentric, 1.7-2.5(-3) µm wide germ-pore (Figs 15, 21). Basidia 35-43 × 9-10.5 µm, clavate to cylindrical, 4-spored (Fig. 13). Cheilocystidia of two kinds, some subglobose (×32-47 µm) intermixed with broadly lageniform (< 40 × 20 µm) to lageniform (50-55 × 15-18 µm) ones, with somewhat tapering neck, 4-8 µm wide at the apex, thin-walled, colourless (Fig. 14). Pleurocystidia very rare or even absent in some lamellae, somewhat vesiculose. Pileocystidia 60-125 × 12-22 µm, lageniform to fusiform, with a somewhat tapering or cylindrical neck 6-10 µm wide, obtuse at apex, thin-walled to moderately thick-walled, colourless or with intraparietal brown pigment, especially towards the base (Fig. 12). Pileipellis a hymenoderm with brown encrusting pigment. Clamp-connections present.

Observations. - Uljé & Bas (1991) have already pointed out the variabilty on the presence/absence of pleurocystidia in this species, which is included in section *Pseudocoprinus* (Kühner) P.D. Orton & Watling, subsection *Setulosi* J.E. Lange, owing to the absence of a veil and the presence of setules (dermatocystidia). Within this subsection, *C. subimpatiens* can be recognized by the ellipsoid to ovoid spores provided with a subeccentric germ-pore, absence of velar elements and mixture of globose and (sub)lageniform cheilocystidia. The closely related *C. callinus* M. Lan-

ge & A.H. Sm. (as pointed out by Uljé & Bas, 1991) differs basically in the absence of lageniform cheilocystidia and narrower spores (6.2-8.2 µm versus 5.7-7.4 µm).

According to our data, this is the first time that this species is recorded from Andalucía, and probably also in the Iberian Peninsula. Its distribution ranges from North America (Lange & Smith, 1953; Redhead, 1984) to Europe, where it is known from England, Germany, Italy and the Netherlands (Orton & Watling, 1979; Krieglsteiner et al., 1982; Lanconelli & Lanzoni, 1988; Bender, 1989; Uljé & Bas, loc. cit., 1991; Keizer & Arnolds, 1994).

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